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UNIVERSITI SAINS MALAYSIA

Kursus Semasa Cuti Panjang  
Academic Session 2007/2008

Jun 2008

**BMT 302/3 – Environmental Microbiology**  
***[Mikrobiologi Persekitaran]***

Duration: 3 hours  
*[Masa : 3 jam]*

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Please ensure that this examination paper contains FIVE printed pages before you begin the examination.

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi LIMA muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]*

**Instructions:** Answer **FIVE** (5) out of **SIX** (6) questions, in English or Bahasa Malaysia. Each question carries 20 marks.

**[Arahan:** Jawab **LIMA** (5) daripada **ENAM** (6) soalan yang diberikan dalam Bahasa Inggeris atau Bahasa Malaysia. Tiap-tiap soalan bernilai 20 markah.]

1. [a] Define and include a specific example for each of the terms listed.

(10 marks)

- [i] Cometabolism
- [ii] Commensalism
- [iii] Mutualism
- [iv] Amensalism
- [v] Synergism

- [b] Define bioremediation. Discuss the benefits and limitations of the process in the management of organic waste.

(10 marks)

2. Discuss the roles of beneficial soil microorganisms in the advancement of agricultural sector.

(20 marks)

3. [a] How does the nitrogenase system of *Streptomyces thermoautotrophicus* differ from other diazotrophs? Explain your answer.

(10 marks)

- [b] Write out the chemical equation of symbiotic N<sub>2</sub> fixation process by diazotrophic microorganisms. What chemical and physical factors affect the function of nitrogenase?

(10 marks)

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4. Describe the molecular adaptations of microorganisms for living in extreme habitats such as low temperature (psychrophilic), high temperature (thermophilic) environment and in high salt concentrations.

(20 marks)

5. What are the potential risks involved with the release of genetically modified organisms (GMOs) into the soil. Explain your answer.

(20 marks)

6. [a] Compare primary, secondary and tertiary sewage treatments as to what they remove.

(10 marks)

- [b] Water is usually tested for safety by using fecal coliforms as an indicator of fecal contamination. However, the validity of this approach has been questioned. Explain your answer.

(10 marks)

1. [a] Berikan definisi istilah berikut dan contoh.

(10 markah)

- [i] Kometabolisme
- [ii] Komensalisme
- [iii] Mutualisme
- [iv] Amensalisme
- [v] Synergisme

- [b] Berikan takrifan bioremediasi. Bincangkan kebaikan dan kelemahan proses ini untuk pengurusan sisa buangan organik.

(10 markah)

2. Bincangkan peranan mikroorganisma tanah berfaedah dalam memajukan sektor pertanian.

(20 markah)

3. [a] Bagaimanakah sistem nitrogenase *Streptomyces thermoautotrophicus* berbeza daripada lain-lain diazotrof? Jelaskan jawapan anda.

(10 markah)

- [b] Tuliskan persamaan kimia proses pengikatan  $N_2$  simbiotik oleh mikroorganisma diazotrof. Apakah faktor-faktor kimia dan fizikal yang mempengaruhi fungsi enzim nitrogenase?

(10 markah)

4. Huraikan adaptasi molekul mikroorganisma untuk terus hidup di dalam habitat lampau seperti dalam persekitaran suhu rendah (psikrofili), suhu tinggi (termofili) dan dalam kepekatan garam yang tinggi.

(20 markah)

5. Apakah potensi risiko yang terlibat dengan pembebasan organisma termodifikasi genetik (GMOs) ke dalam tanah. Jelaskan jawapan anda.

(20 markah)

6. [a] Bandingkan rawatan kumbahan primer, sekunder dan tertiar berdasarkan apa yang disingkirkan daripada kumbahan tersebut.

(10 markah)

- [b] Air lazimnya diuji untuk keselamatan dengan menggunakan fecal coliforms sebagai penunjuk pencemaran najis. Bagaimanapun ketepatan kaedah ini telah di ragui. Jelaskan jawapan anda.

(10 markah)